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ATYPICAL INCUBATION RATES AT A NEW MEXICO PEREGRINE FALCON EYRIE

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Ratcliffe (1981) reported that in the Peregrine Falcon (*Falco peregrinus*) incubation during the daytime is mainly by females. Cramp and Simmons (1980) reported incubation is primarily by the female during the day and probably entirely at night. Of seven literature sources on Peregrine Falcon incubation (Dunaeva et al. 1948, cited in Cade 1960; Nelson 1970; Enderson et al. 1972; Harris and Clement 1975; Eberhardt and Skaggs 1977; Hunt 1979; Ratcliffe 1981), four indicate that males may incubate as much as one-half of the daytime period. This paper describes the atypical behavior of a pair in northern New Mexico in which the male's role greatly exceeded 50% of daytime incubation.

Nelson (1970) estimated males on Langara Island, British Columbia, at mid-incubation spent 30–50% of the daytime on eggs, but this decreased towards the end of the incubation period. Eberhardt and Skaggs (1977) discovered a male incubating 63% of the time in southern New Mexico. At another eyrie, on a day after a snowstorm, they observed a male incubate only 19% of the time in 11 hr. Hunt (1979) found a male's participation in northern California peaked at 60% about 5–10 d prior to hatching. Overall, the male incubated about 44% of the observed time. Ratcliffe (1981:219) reported that T. Cade found that captive male Peregrines incubate, but their share varies greatly between individuals, reaching up to one-half of the daytime incubation. Time-lapse photography was used to accurately quantify incubation-sharing at five nests in late incubation on the Yukon River (Enderson et al. 1972). No male incubated 50% of daylight hours. At three nests 11–15 d before hatching, males averaged 39% (range 32–45%) of daylight incubation; at four nests, 6–10 d before hatching, males averaged 34% (range 31–37%); and at five nests, 0–5 d before hatching, males averaged 29% (range 15–41%), or an average of 34% incubation by males 15 d before hatching.

During the spring of 1982, I studied a pair of nesting Peregrines in northern New Mexico from late courtship until fledging of young. The eyrie was on a protected ledge of southeast aspect. Incubation began 6 April and lasted until 9 May when the first food deliveries suggested hatching. During this period, I watched 202 hr in 18 d. Observations were made continuously throughout the daylight period. On seven d (39%) observations were made from dawn to dusk. The mean times were between 0556 H and 1829 H (MST). The pair was observed with binoculars and spotting scope about 300 m from the eyrie. My presence did not appear to disturb them.

The male incubated an average of 63% (range 27–87%) of the daylight hours from 6 April to 9 May (Fig. 1) and averaged 154 min/incubation bout. The female incubated an average of 37% (range 12–72%) of the daylight hours and averaged 70 min/incubation bout. The female incubated a greater percentage of the day than the male on only two d, 30 April (55% vs. 44%) and 9 May (72% vs. 27%), the day of hatching. From mid-incubation onward, the male's role diminished, but the male continued to incubate longer than the female until shortly prior to egg hatching.

A typical incubation day was as follows; at first light (±0500 H) the male relieved the female for 2–4 hr. She returned to the eyrie and incubated while he hunted. Once prey was caught the male fed and immediately hunted again, consumed half of the prey and took the other half to the female, or took all of the prey to her. In the latter case he sometimes hunted for himself while the female ate and returned to the eggs, though generally whenever she was away from the eggs the male would incubate. If he was on the eggs when she finished eating, she perched for another 1–2 hr. Normally there were four or five nest exchanges/d. The male incubated for a greater part of the afternoon with the female relieving him near dusk. The female incubated overnight seven times between dark and first light. Only twice did it appear that the male may have incubated overnight, but I left the observation site shortly before dark and could not verify the next morning. Typically the female arrived at the eggs 15–30 min before dark and in two cases, the male was on the eggs within 15 min of darkness.

The eyrie was in sunlight from ±0600–1230 H when both sexes incubated equally. I found no correlation between either sex incubating and the presence of extremes in temp and precipitation. The male incubated as long as 5 hr 51 min in one period, and only twice did he leave the eggs before being relieved by the female. On 23 April, after 5 hr 20 min, and on 2 May, after 3 hr 16 min, the male left before the female relieved him. In the latter case, the female was perched nearby 36 min after the male began incubating. Two hr and 36 min later, she was still at the same nearby perch. Within two min the male left the eyrie and called; the female left her perch, called, and flew to the eyrie. On both exchanges eggs were unattended for only one min.

On occasion the week prior to hatching, the bird incubating would not leave the eggs in order to be relieved. A "confrontation" then occurred but normally lasted only 20–50 sec. One such confrontation/d was observed on 6, 7, and 8 May, and six occurred on 9 May, the hatching date. On 9 May, three occurred after the first egg was presumed to have hatched. Of 10 total confrontations observed at the eyrie the male "won" once, resulting in the female being turned away at the eyrie, and twice he relinquished incubation. This supports Cade's impression (1960) that birds incubate most intensely just before hatching. Nelson (1970) and Wrege and Cade (1977) indicated that the female controls the relief schedule. If the male is sitting, he leaves almost immediately as the female arrives; if the female is sitting, she is less inclined to depart, and the male may have to beg for his turn by calling (Herbert and Herbert 1965). Although there is no mention in the literature of the female regulating the schedule by being away from the eyrie, this behavior could also be interpreted as a form of control by the female.

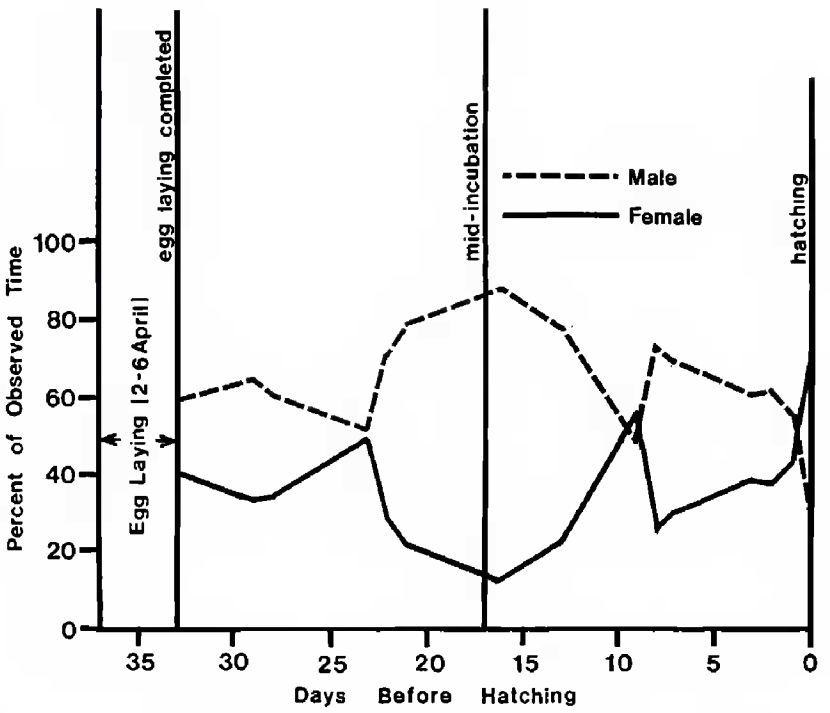

Figure 1. Percent of observed time engaged in incubation by an adult male and female Peregrine Falcon in New Mexico in relation to the number of days before hatching of eggs.

I infer that the female of this New Mexico pair may have had some control over the incubation schedules by her actions around the eyrie. She may have had a subnormal inclination to incubate or perhaps was a first-time breeder and thus inexperienced. In either case the result was abnormally long incubation bouts by the male, most of these occurring when the female was perched in the eyrie canyon and often visible to the incubating male.

During the male's 51 incubation bouts of a combined 6292 min, the female was either outside the eyrie canyon or outside my view during 1628 min (26%). The female was ≤0.5 km from the eyrie during 4664 min (74%). In contrast to the different incubation rates, brooding behavior was similar to other Peregrines. The female brooded 94% (range 82–100%) and the male 6% (range 0–17%) during seven days between four and 24 d post-hatch (four young fledged).

The role of the sexes in incubation from several regions is seen from a different perspective when compared to the New Mexico pair. A male northern Peregrine might incubate for a longer time than one in the south because of the longer daylength, or for the same number of hours regardless of photoperiod. In northern latitudes with cooler

ambient temp, females with a larger body size are better able to incubate a large clutch of eggs than a male (Cade 1960). If climate and latitude affect incubation duties, then rates at each latitude should reflect severity of the climate at the eyrie (i.e., females taking a larger share of duties in northern latitudes and less in the south). It is difficult to speculate from the limited data available how much latitude and climate influence incubation rates, though there appears to be much variation. When incubation rates of the northern New Mexico pair are compared to others, it is clear that the male incubated for a greater length of time/d and had a higher daytime incubation rate than reported elsewhere. Closer observations of incubating Peregrines are needed at different latitudes and climates in order to determine how the sexes are influenced by such factors as latitude, daylength, climate and individual behavioral variability.

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NEST SITE CHARACTERISTICS OF PRAIRIE FALCONS IN THE MOJAVE DESERT, CALIFORNIA

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Runde and Anderson (1986) summarized characteristics of Prairie Falcon (*Falco mexicanus*) nest sites in the western U.S. from written accounts (Decker 1931; Enderson 1964; Leedy 1972; Ogden 1973; Porter and White 1973; Platt 1974; Denton 1975; Ogden and Hornocker 1977; Williams 1981) and from their own work. Data from virtually all western states were included, except Arizona and California. This paper supplements Runde and Anderson's (1986) summary because: 1) the Mojave Desert is a major biotic province (Mojavian; Dice 1943) containing a large breeding population of Prairie Falcons (Boyce et al. 1986) for which nest site characteristics have not been previously reported in detail, 2) some of my findings for the Mojave Desert differ from their data, and 3) I include data gathered at 44 nests studied by Millsap (1984) in westcentral Arizona.

I collected data on characteristics of Prairie Falcon nest sites in the Mojave Desert, California, from 1977 to 1979. In this report *nest site* refers to a specific location where falcons nest, usually a cliff but there are exceptions (cf.,